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(71)Applicant : NIPPON TELEGR & TELEPH CORP <NTT>

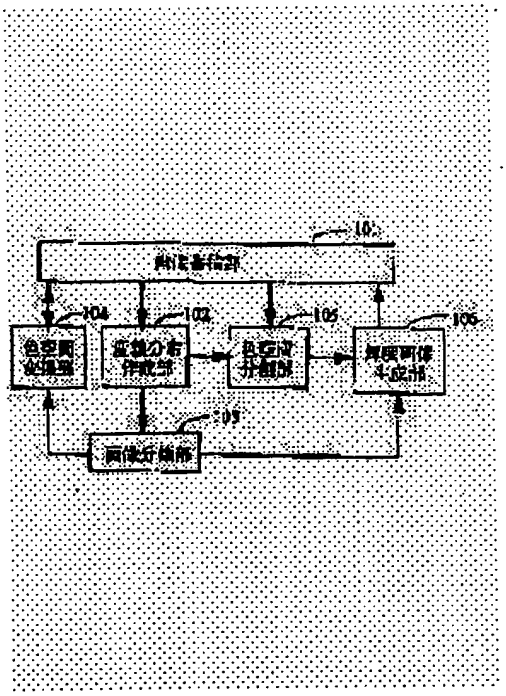
(72)Inventor : KAWAMURA HARUMI
AKIMOTO TAKAAKI
SUZUKI SATOSHI

(54) METHOD AND DEVICE FOR GENERATING LUMINANCE IMAGE AND RECORDING MEDIUM RECORDING THIS METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To convert a natural image into a normal luminance image and to output a luminance image that makes the distinction of different color areas clear on an artificial image by providing an image classifying means which classifies color images into the natural image and the artificial image.

SOLUTION: A frequency distribution generating part 102 calculates the number of colors which have pixel values that are the same or close to a color image in an image accumulating part 101 in color space. An image classifying part 103 classifies the input color image into either a natural image or an artificial image based on a result of the part 102. A color space transforming part 104 transforms each pixel value on RGB space to an image that is classified as the artificial image in the part 103 into a value on color space that corresponds to human perception. As for an image that is classified to the natural image in the part 103, a luminance image is generated by allocating a luminance level to each pixel value in accordance with the gradation reproductive range of an output device.



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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] The frequency-distribution creation section which creates the frequency distribution of the pixel value in a color picture in the equipment which changes a color picture into a brightness image, The image classification section which classifies an input color picture into a natural image and an artificial image based on the frequency distribution of a pixel value, In the color space conversion section which changes the color space of a color picture into the color space corresponding to human being's perception, the color space division section which divides a color space into two or more subspaces based on the frequency distribution of a pixel value, and said image classification section When the intensity level according to the gradation expression range of output equipment is assigned to each pixel value when classified into a natural image, and classified into an artificial image Brightness image generation equipment characterized by having the brightness image generation section which generates a brightness image by assigning the intensity level according to the gradation expression range of output equipment to each subspace divided on the color space.
[Claim 2] The first processing process which creates the frequency distribution of a pixel value to a color picture in the approach of changing a color picture into a brightness image, From the frequency distribution of a pixel value, according to the second processing process which classifies an image into a natural image and an artificial image, and said second processing process When classified into a natural image, according to the third processing process which assigns the intensity level according to the gradation expression range of output equipment to each pixel value, and said second processing process The fourth processing process which changes the color space of a color picture into the color space corresponding to human being's perception when classified into an artificial image, The fifth processing process which creates the frequency distribution of a pixel value to the color space changed according to the fourth processing process, The sixth processing process which divides the color space by the fourth processing process into two or more subspaces based on the frequency distribution by the fifth processing process, The seventh processing process to which the number of pixels unifies little subspace with other subspaces to the division result by the sixth processing process, The brightness image generation method characterized by having the eighth processing process which assigns an intensity level according to the gradation expression range of output equipment to the subspace obtained according to the seventh processing process.
[Claim 3] In the record medium which recorded the processing process which changes a color picture into a brightness image The processing process concerned to a color picture by the first processing which creates the frequency distribution of a pixel value, the second processing which classifies an image into a natural image and an artificial image from the frequency distribution of a pixel value, and said second processing When classified into a natural image, by the third processing which assigns the intensity level according to the gradation expression range of output equipment to each pixel value, and said second processing The fourth processing which changes the color space of a color picture into the color space corresponding to human being's perception when classified into an artificial image, The fifth processing which creates the frequency distribution of a pixel value to the color space changed by fourth

processing, The sixth processing which divides the color space by the fourth processing into two or more subspaces based on the frequency distribution by the fifth processing, The seventh processing whose number of pixels unifies little subspace with other subspaces to the division result by the sixth processing, The record medium which recorded the processing process of the brightness image generation characterized by recording the eighth processing which assigns an intensity level according to the gradation expression range of output equipment to the subspace obtained by seventh processing.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the record medium which recorded the brightness image generation method which changes a color picture into a brightness image and outputs it to output equipment, such as FAX, a printer, etc. with few gradation expressions, equipment, and this approach.
[0002]
[Description of the Prior Art] Usually, a color picture expresses the color of each pixel in an image in the combination of R (red), G (green), and B (blue) in many cases. In that case, with conventional brightness image generation equipment, the brightness image was generated based on the formula (1) by changing each pixel value of an input color picture into the brightness component Y.
[0003]
Y(x y) =0.299, R(x y)+0.587, G(x y)+0.114, and B (x y) ..... (1) Here, R (x y), G (x y), and B (x y) are the pixel values of each R [in the coordinate on an image (x y)] (red), G (green), and B (blue) component, and Y (x y) expresses the brightness component in the same coordinate. Moreover, "-" expresses a product.
[0004]
[Problem(s) to be Solved by the Invention] In the brightness conversion based on a formula (1), since coincidence or the case of being mutually near arose [a brightness component] even if colors, i.e., the combination of (R, G, B), differ, there was a problem of being hard coming to distinguish the field of the different color on a brightness image. In an image including the alphabetic character and graphic form of the color which people drew especially, the problem of making difficult content decipherment of the brightness image which it is as a result of [the] conversion is produced. In addition, about a natural image, the direction which changes according to a formula (1) can obtain a brightness image without sense of incongruity.
[0005] Moreover, in case a color picture was changed into a brightness image and outputted to a device which expresses two or more gradation by two kinds of white and black, such as FAX, when there were few expressions of the gradation by binary than the number of gradation expressions of the brightness component Y of a color picture, there was also a problem that gradation of low brightness or a high brightness part could not fully express.
[0006] The former example is shown in (a) of drawing 3 . The input image of drawing 3 indicates from the left the character string of the red the "Yokosuka R&D center" by superposition in the center blue from white on the right on the background from which a color changes gently-sloping. The result of having changed this image into the brightness image based on the above-mentioned formula (1) is drawing 3 (a), and since some brightness components of an alphabetic character and a background become the same, the example to which an alphabetic character becomes not clear is shown.
[0007] About a natural image, this invention is gradation expression within the limits of output equipment, performs conversion in the usual brightness image, and aims at offering the record medium which recorded the approach of outputting the brightness image with which distinction of a color field

which is different about an artificial image according to the gradation expression range of output equipment in the case of conversion in a brightness image becomes clear, equipment, and this approach.
[0008]
[Means for Solving the Problem] In order to solve the above-mentioned technical problem, in this invention, a color space division means to divide a color space into two or more subspaces is used to an image classification means to classify a color picture into a natural image and an artificial image, a brightness image generation means to output a brightness image according to the gradation expression range of output equipment, and the image classified into the artificial image.
[0009]
[Embodiment of the Invention] Hereafter, one example of the brightness image generation equipment concerning this invention is explained to a detail with reference to a drawing.
[0010] For the frequency-distribution creation section and 103, as for the color space conversion section and 105, in drawing 1, the image classification section and 104 are [101 / the image storage section and 102 / the color space division section and 106] the brightness image generation sections. Moreover, drawing 2 is the flow chart having shown the flow of processing.
[0011] The configuration and function of each part are explained in order, referring to drawing 1 and drawing 2.
The <image storage section> In :101 image-storage section 101, a color picture, a brightness image, and the image generated in the process which creates a brightness image are accumulated.
The <frequency-distribution creation section> In :102 frequency-distribution creation section 102, it asks for the number of the colors which have a same or near pixel value in a color space from the color picture in the image storage section 101 (the creation 202 of the drawing 2 frequency distribution, and 206 reference). The color space used here is the uniform color space corresponding to perception, and Y and L* of human beings, such as color spaces, such as RGB and XYZ, Munsell, and CIELUV, CIELAB. As long as two-dimensional chromaticity coordinates, such as a brightness shaft [like], xy, and u'v', etc. are the space which evaluated the color, you may be what kind of space. The result depended on the frequency-distribution creation section 102 is transmitted to the image classification section 103 or the color space division section 105.
The <image classification section> Based on the result of the frequency-distribution creation section 102, an input color picture is classified into a natural image or an artificial image according to :103 image classification section 103 (classification 203 reference of the drawing 2 image). The judgment at the time of classifying is performed to the total number of pixels based on the rate that the maximum frequency occupies. That is, when the maximum of frequency distribution accounts more than for the fixed rate of the total number of pixels, consider as an artificial image and let except [its] be a natural image.
The <color space conversion section> In :104 color-space-conversion section 104, each pixel value on RGB space is changed into the value on the color space corresponding to human being's perception to the image classified into the artificial image in the image classification section 103 (conversion 205 reference of the drawing 2 color space). In the color space corresponding to human being's perception, the HVC space which expresses a color by the three attributes of color of a hue, saturation (or saturation ratio), and lightness (or reinforcement), HSI space, HSV space, etc. CIELUV, uniform color space like CIELAB, etc. are located like Munsell color system again.
[0012] After the image data after a color space conversion is transmitted to the image storage section 101, in the frequency-distribution creation section 102, the frequency distribution of the color space corresponding to human being's perception are created.
The <color space division section> In :105 color-space division section 105, the color space corresponding to human being's perception is divided into two or more subspaces based on the result of the frequency-distribution creation section 102 (the division 207 of the drawing 2 color space, and integrated 208 reference of subspace with few pixels). Processing of the color space division section 105 is shown below.
[0013] **1** Ask for the data range of a brightness component and a **** component from frequency

distribution, and determine the range of the brightness component it can be considered that is the same color, and a **** component (Lth, Cth).
2 Detect the maximum of frequency distribution, attach the same identifier to the pixel in which a brightness component and a **** component have the color contained in the range of Lth and Cth focusing on the color corresponding to the maximum, and form subspace.
[0014] **3** When an identifier operates <2> similarly and attaches an identifier to all pixels to a non-set up pixel, divide into two or more subspaces with an identifier which is different in a color space.
[0015] **4** When there are few pixels contained in one subspace, a brightness component unifies with near different subspace on a color space.
Actuation of resulting [from above-mentioned <1>] in <4> divides a color space into two or more subspaces.
[0016] The result of the color space division section 105 is transmitted to the brightness image generation section 106.
The <brightness image generation section> In :106 brightness image generation section 106, to a natural image and each artificial image, a brightness image is generated and a result is transmitted to the image storage section 101 (it is [the assignment 204 of an intensity level, and] quota 209 reference of an intensity level for every subspace for every drawing 2 pixel value).
[0017] To the image classified into the natural image in the image classification section 103, a brightness image is generated by assigning an intensity level as follows to each pixel value according to the gradation rendering range of output equipment (it is quota 204 reference of an intensity level for every drawing 2 pixel value).
[0018] First, the pixel value on the RGB space in the coordinate (i, j) of an image is changed into the brightness component Y (i, j) according to a formula (1). next, maximum Ymax of a brightness component And the minimum value Ymin It asks and asks for output-value Y' (i, j) of brightness according to a formula (2) according to the gradation expression range of output equipment (here -- Y1 -- the above -- Y2 -- it considers as the following).
[0019]
Y'(i, j) =scale and (Y(i, j)-Ymin) +Y1 scale =(Y2-Y1)/(Ymax-Ymin) ..... (2) A brightness image is generated by assigning the same intensity level to the color contained in the color space division section 105 in the same subspace to the image classified into the artificial image (it is quota 209 reference of an intensity level every R> drawing 2 2 subspace).
[0020] First, based on those color components or a brightness component, sequence is assigned to subspace to the color contained in the same subspace. Next, according to the gradation expression range of output equipment, the sequence assigned to each subspace is changed into an intensity level based on the following formulas (3). A formula (3) shows the case (the number of sequence is as large as high brightness) where sequence is assigned to order with low brightness.
[0021]
Y'(i, j) =interval-Order+(Index (i, j)) Y1 interval=(Y2-Y1)/(N-1) ..... (3) The identifier of the subspace where, as for N, the number of partitions of a color space belongs, and, as for Index (i, j), the pixel value of a coordinate (i, j) belongs, and Order (k) here The sequence and Y1 which were assigned to the subspace whose identifier is k And Y2 It considers as the maximum and the minimum value of the gradation expression range of output equipment, respectively.
[0022] This invention is realizable also by performing processing based on the content of the record medium concerned using the record medium which recorded processing according to the flow of the aforementioned processing shown especially in drawing 2 . Therefore, this invention contains the record medium itself [concerned] in the technical range of this invention.
[0023]
[Effect of the Invention] Conversion in a brightness image can be realized without losing the information which an input color picture has from the pixel value distribution of a color picture by classifying an input color picture into a natural image and an artificial image, discretizing a color space by dividing a color space into two or more subspaces in the case of an artificial image, and assigning an

intensity level according to the gradation expression range of output equipment according to this invention.

[0024] Drawing 3 (b) is the result of changing into a brightness image by this invention to the same input image (image with which a superposition indication of the character string "the Yokosuka R&D center" on the background which changes from white to blue gently-sloping with red color was given) as drawing 3 (a). By the brightness image based on this invention, in order to assign an intensity level which is different in an alphabetic character field and a background region, both distinction becomes easy.

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TECHNICAL FIELD

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PRIOR ART

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EFFECT OF THE INVENTION

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[0024] Drawing 3 (b) is the result of changing into a brightness image by this invention to the same input image (image with which a superposition indication of the character string "the Yokosuka R&D center" on the background which changes from white to blue gently-sloping with red color was given) as drawing 3 (a). By the brightness image based on this invention, in order to assign an intensity level which is different in an alphabetic character field and a background region, both distinction becomes easy.

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TECHNICAL PROBLEM

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[0005] Moreover, in case a color picture was changed into a brightness image and outputted to a device which expresses two or more gradation by two kinds of white and black, such as FAX, when there were few expressions of the gradation by binary than the number of gradation expressions of the brightness component Y of a color picture, there was also a problem that gradation of low brightness or a high brightness part could not fully express.
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MEANS

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[0014] **3** When an identifier operates <2> similarly and attaches an identifier to all pixels to a non-set up pixel, divide into two or more subspaces with an identifier which is different in a color space.
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The <brightness image generation section> In :106 brightness image generation section 106, to a natural image and each artificial image, a brightness image is generated and a result is transmitted to the image storage section 101 (it is [the assignment 204 of an intensity level, and] quota 209 reference of an intensity level for every subspace for every drawing 2 pixel value).
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[0020] First, based on those color components or a brightness component, sequence is assigned to subspace to the color contained in the same subspace. Next, according to the gradation expression range of output equipment, the sequence assigned to each subspace is changed into an intensity level based on the following formulas (3). A formula (3) shows the case (the number of sequence is as large as high brightness) where sequence is assigned to order with low brightness.
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gradation expression range of output equipment, respectively.
[0022] This invention is realizable also by performing processing based on the content of the record medium concerned using the record medium which recorded processing according to the flow of the aforementioned processing shown especially in drawing 2 . Therefore, this invention contains the record medium itself [concerned] in the technical range of this invention.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram showing one example of this invention.
[Drawing 2] It is the flow chart showing the flow of processing of the brightness image generation method by this invention.
[Drawing 3] It is drawing showing the difference in the processing result in the conventional brightness inverter and the brightness inverter of this invention.
[Description of Notations]
101: Image storage section
102: Frequency-distribution creation section
103: Image classification section
104: Color space conversion section
105: Color space division section
106: Brightness image generation section

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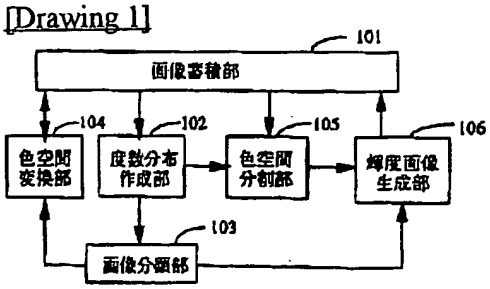
DRAWINGS

[Drawing 1]

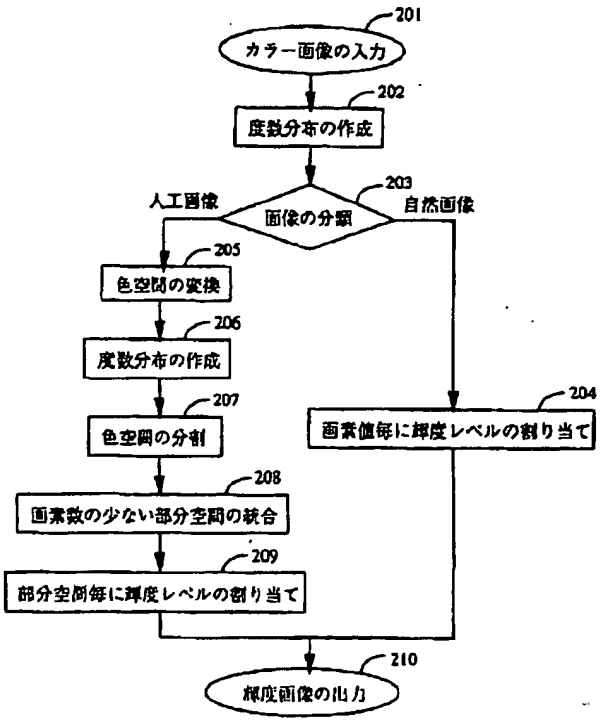


[Drawing 3]

(a)

(b)

[Drawing 2]



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